

NEW POLARADIOMETRIC METHOD FOR NON-CONTACT TEMPERATURE MEASUREMENT, A. Abtahi and M. Barmatz, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109.

The Polaradiometer is a new non-contact temperature measurement system that eliminates the need for knowledge of the surface characteristics of the sample. This instrument is insensitive to surface emissivity and roughness effects and thus accurate true temperature measurements can be performed on materials ranging from metals to ceramics even for surface properties that change with time. This instrument should be of value in ground-based as well as space applications where accurate non-contact true temperature measurements are required. The principle of operation of the Polaradiometer is based on the fact that the effect of emissivity on the process of emission is complementary to its effect on the process of reflection. Specifically, radiation emitted at an angle from a surface is polarized, meaning the emissivities corresponding to the two primary directions of polarization are different from each other. The same holds true for radiation reflected from the surface, except that because the reflectivity is the determining factor here, the effect of the reflection on the polarization of the reflected light is exactly opposite to that on the emitted light. The Polaradiometer essentially works by combining the emitted radiation with the reflected radiation and measuring the polarization state of the combined radiation. The intensity of the source of the reflected light is adjusted until the combined light is unpolarized. It can be shown that when that polarization null is achieved the intensity of the source of the reflected light represents the true temperature of the sample regardless of its surface characteristics, i.e., the blackbody temperature of the source is equal to the true temperature of the sample. The radiation intensity of the source can easily be calibrated against a standard to accurately determine the true temperature of the sample. The basic principle of operation of the Polaradiometer has previously been demonstrated. The purpose of the present work is to perform a more detailed proof of concept. In this talk, we will present temperature measurements on a set of diffuse and specular surfaces. The Polaradiometer measurements will be compared to a thermocouple mounted on the sample holder and the accuracy and repeatability of the measurements will be discussed. [Work supported by NASA]